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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Combination Bond Method for Nonwoven Fabrics

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ABSTRACT OF THE DISCLOSURE

A method of providing a bonded article such as nonwoven protective article for agricultural crops is disclosed. The nonwoven article is produced by joining a plurality of nonwoven sheets together along their longitudinal edges to provide a nonwoven article of increased width. The sheets are joined by forming a combination hot melt adhesive/sonic bonded seam between abutting edges. The combination seam has good tensile strength and an increased resistance to peeling over seams which are only adhesive or only sonic bonded.

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PATENT

COMBINATION BOND METHOD FOR NONWOVEN FABRICS

Technical Field

The present invention relates to a method for bonding articles such as nonwovens, and more particularly relates to a method of bonding nonwoven materials utilizing high frequency sonic bonding in conjunction with a hot melt adhesive to provide a combination adhesive/sonic bond having increased resistance to peeling.

Background of the Invention

Nonwoven, disposable materials are well known in the art and have many uses. One use for such materials is as a protective covering for tender agricultural crops, such as strawberries and tobacco. Each year weather elements such as wind and/or frost damage destroy a significant number of crops. To protect crops from weather, large sheets of nonwoven material are positioned over the crops in the field.

Because nonwoven materials are typically manufactured in sheets having a width, such as about ten feet for example and because such crops are typically grown in beds having a wider width, such as about fifty feet, it is common practice to join several sheets together to form a nonwoven covering wide enough to cover an entire bed of crops. Various methods have been employed to seam or otherwise join the sheets together to form a protective covering large enough to cover crops. These methods include adhesively securing the sheets together, sewing or stitching the sheets together, and bonding the sheets together using high frequency sonic welding. Various types of seams may be employed which contact the sheets to be joined. As used herein the term "butt seam" refers to

seams wherein the same surface of both sheets contact each other , e.g. top to top or bottom to bottom and "lap seam" refers to seams where opposing, e.g., top to bottom, surfaces contact each other.

A seam which joins individual sheets together is subject to a variety of stresses, especially when used as an agricultural covering. For example, a seam joining nonwoven materials to form an agricultural covering must have good tensile strength to resist rupture from stresses applied laterally across the seam, such as occur from handling of the covering during placement over crops. Such a seam must also resist longitudinal separation or peeling which can result from stresses which act vertically on the seam, such as can occur from strong winds whipping the covering.

Seams formed by each of the above methods have good tensile strength and thus perform well when subject to laterally applied stresses. Sewn seams also exhibit good resistance to peeling, but are very expensive to produce compared to adhesive or sonic weld seams. Adhesive seams and sonic weld seams are inexpensive but exhibit a low resistance to peeling. As a result protective coverings having only adhesive or only sonic weld seams have a high rate of failure in the field, especially when used in windy conditions.

Therefore a need exists for an inexpensive method for joining nonwoven sheets which provides a seam having good tensile strength and improved resistance to peeling.

Summary of the Invention

The present invention solves the above described need by providing a method for joining members such as nonwoven sheets with a combination adhesive and sonic bonded seam having good tensile strength and improved resistance to peeling.

Generally described, the present invention provides a

process for producing a combination adhesive and sonic bond between members of an article, the process comprising the steps of contacting surfaces of the members along the path of the intended bond while introducing an adhesive between the contacting surfaces; and inducing mechanical, friction-producing vibrations along the path of the intended bond to form the combination bond and thereby join the contacting surfaces to one another.

More particularly, the present invention provides a method for providing a combination adhesive and sonic bonded seam between two abutting edges of a material, the method comprising the steps of introducing an adhesive between an initial position of the abutting edges in the position desired for the combination seam; and laterally moving the abutting edges past a source of sonic energy to form the combination seam along the edges at the desired position while continuously introducing the adhesive between successive portions of the abutting edges to form the combination seam along the successive portions and thereby continuously join the abutting edges together.

Accordingly, an object of the present invention is to provide an improved method for joining members of articles, such as nonwoven sheets.

It is also an object of the present invention to provide a combination adhesive and sonic bonded seam.

Yet another object is to provide a method for producing a protective covering for agricultural crops.

It is still a further object of the present invention to provide a seam having improved resistance to separation.

Other objects, features, and advantages of the present invention will become apparent upon reading the following detailed description of embodiments of the invention, when taken in conjunction with the appended claims.

Brief Description of the Drawings

Fig. 1 is a schematic diagram of a seam forming apparatus

which is used to join nonwoven materials in accordance with the present invention.

Fig. 2 is a perspective view of a butt seam made in accordance with the method of the present invention.

Fig. 3 is a perspective view of a lap seam made in accordance with the method of the present invention.

Fig. 4 is a perspective view showing a nonwoven article made in accordance with the present invention positioned to protect crops from weather.

Detailed Description of the Invention

Turning to Fig. 1, there is shown a seam forming apparatus 10 used to join nonwoven sheets in accordance with the present invention. Particularly, the apparatus 10 consists of a plurality of advancing rolls 12 for advancing a pair of nonwoven sheets 20 and 21, a pair of folding boards 30 and 31, a glue nozzle 40, an ultrasonic horn 50, and a patterned anvil roll 60. The rolls 12 rotate in the direction of the arrows associated therewith to advance the nonwoven sheets 20 and 21 in the direction indicated by the arrows associated therewith. The sheets 20 and 21 are advanced through the folding boards 30 and 31, respectively, which are conventional in design. The folding boards 30 and 31 provide butt seams 34 and 35, respectively, (shown in Fig. 2) on a longitudinal edge of each of the sheets 20 and 21 in a manner which is well known in the art. As the sheets 20 and 21 advance down line of the folding boards 30 and 31, the rolls 12 guide the sheets 20 and 21 such that the butt seams 34 and 35 are positioned adjacent to one another at point "A." The glue nozzle 40, positioned just upstream of point A, is attached to a conventional hot melt supply 41 and sprays a conventional hot melt adhesive 42 onto the mutually facing surfaces of the butt seams 34 and 35 just prior to point A to form a butt seam/hot melt interface. Immediately down line of point A the butt seam/hot melt interface is nipped

together by the ultrasonic horn 50 and the patterned anvil roll 60 located at point B to join the butt seams 34 and 35 together and thereby form a combination adhesive/sonic bonded seam 70, (shown in Fig. 2) having improved resistance to longitudinal separation or peeling.

The nonwoven sheets 20 and 21 are preferably nonwoven spunbonded webs having a basis weight of between about 0.5 and 1.5 ounces per square yard ("osy"). Such material is well known in the art and may be prepared in conventional fashion such as illustrated by the following patents: Dorschner et al. United States Patent No. 3,692,618; Kinney United States Patent Nos. 3,338,992 and 3,341,394; Levy United States Patent No. 3,502,538; Hartmann United States Patent Nos. 3,502,763 and 3,909,009; Dobo et al. United States Patent No. 3,542,615; Harmon Canadian Patent No. 803,714; and Appel et al. United States Patent No. 4,340,563. Other nonwoven materials and methods for forming nonwoven materials are contemplated for use with the present invention. In addition, it is also contemplated that the method of the present invention may be used to join other materials, such as woven materials, foams, and plastics.

The glue nozzle 40 is of conventional design and preferably sprays the hot melt adhesive at a rate of between about 5-25 grams/15 second when the sheets 20 and 21 are traveling at a preferred line speed of about 500 feet per-minute. Any adhesive medium may be used, however, a preferred adhesive is a hot melt adhesive known as HL-1202X, available from H. B. Fuller. Co. of St. Paul, Minnesota. This adhesive is preferred because it provides good adhesive strength in cold extremes.

The ultrasonic horn 50 transmits mechanical vibrations to the sheets 20 and 21. The mass and shape of the horn determines the length at which the horn will oscillate at the optimum frequency. The optimum frequency is determined by a conventional power source having a frequency which may vary from a few thousand cycles per second up to a million

or more cycles per second. The operation and construction of such an ultrasonic horn is well known in the art, as shown by United States Patent No. 3,660,186, incorporated herein by reference. While any shape of horn may be used, it has been experienced that a round horn provides superior results as long as it is not allowed to become excessively hot such that overbonding or pinholes occur in the seam. An effective method for cooling the horn is to continuously contact the complete surface of the horn with an air stream. The air stream may be routed in such a manner by flowing the stream through a slotted annular ring positioned around the horn.

The patterned anvil roll 60 is driven by a belt 62 connected to a motor 63 such that the anvil roll 60 may rotate at a speed other than the line speed, with a preferred speed of between about 110 and 120 percent of the line speed in the direction of the arrow shown therewith. The anvil roll 60 functions as a moving arcurate surface against which the ultrasonic horn 50 can work. The horn 50 and the anvil roll 60 are preferably mounted on an adjustable frame (not shown) such that the position of the horn 50 and the anvil roll 60 may be adjusted relative to one another. The outer surface of the anvil roll 60 is provided with a raised pattern such as spots or grids. A preferred pattern is that provided by the RHT pattern roll generally as shown in Design Patent 239,566 to Vogt dated April 13, 1976, assigned to Kimberly-Clark Corporation, the assignee of the present invention. The sheets 20 and 21 passing through point B contact the patterned anvil roll 60 such that raised areas corresponding to the pattern are provided on the sheets. These raised areas are then bonded to one another by the ultrasonic energy and the adhesive to form primary bond areas having improved strength over conventional bond areas formed by ultrasonic bonding or adhesive alone. In addition, the vibrations from the ultrasonic horn intermixes the adhesive around the unbonded areas to provide secondary bonds which aid in increasing

the total strength of the seam.

Referring now to Fig. 2, there is shown a nonwoven article 80 formed by providing the combination seam 70 along the abutted butt seams 34 and 35 of the sheets 20 and 21 using the apparatus of Fig. 1. While the present invention has been described with respect to providing a combination adhesive/sonic bonded seam between abutted butt seams, it will be understood that the process of the present invention may also be used to provide a combination adhesive/sonic bonded seam for otherwise aligned nonwoven sheets. For example, as shown in Fig. 3, a combination adhesive/sonic bonded seam 170 may be provided along overlapped edges 134 and 135 of nonwoven sheets 120 and 121. It will also be understood that multiple sheets may be passed between the anvil and the horn, with a spray nozzle for applying adhesive provided to apply adhesive between adjacent sheets prior to their passage between the horn and the anvil. Alternatively a seam can also be formed between folded edges of a single sheet.

Using the seam forming apparatus 10 to form a combination adhesive sonic bonded seam in accordance with the process of the present invention it is possible to join nonwoven sheets to provide nonwoven articles of virtually any length or width. For example, as shown in Fig. 4, a protective covering 100 for placement over crops 102 may be provided by joining a plurality of nonwoven sheets 103 together with combination adhesive/sonic bonded seams 105 located between the individual sheets. The foregoing description relates to preferred embodiments of the present invention, and modifications or alterations may be made without departing from the spirit and scope of the invention as defined in the following claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A process for producing a combination adhesive and sonic bond between members of an article, said process comprising the steps of:

applying an adhesive medium to a surface of one or more of said members;

contacting a plurality of said members in a manner so that said adhesive is positioned between the surfaces of said members; and

inducing mechanical, friction-producing vibrations in said one or more members to form a bond and thereby join said surfaces to one another.

2. The process of Claim 1, wherein said adhesive medium comprises a hot melt adhesive.

3. A process for producing a combination adhesive and sonic bonded seam between members of an article, said process comprising the steps of:

abutting surfaces of the members along the path of the intended seam while introducing an adhesive medium between the abutting surfaces; and

inducing mechanical, friction-producing vibrations along the path of the intended seam to form said combination seam and thereby join said abutting surfaces to one another.

4. The process of Claim 3, wherein said adhesive medium comprises a hot melt adhesive.

5. A process for producing a combination adhesive and sonic bonded seam between overlapped members of an article, said process comprising the steps of:

introducing an adhesive between the overlapped members along the path of the intended seam; and

inducing mechanical, friction-producing vibrations

along the path of the intended seam to form said seam and thereby join said overlapped surfaces to one another.

6. A method for providing a combination adhesive and sonic bonded seam between two abutting edges of a material, said method comprising the steps of:

introducing an adhesive between an initial position of said abutting edges in the position desired for said combination seam; and

laterally moving said abutting edges past a source of sonic energy to form said combination seam along said edges at said desired position while continuously introducing said adhesive between successive portions of said abutting edges to form said combination seam along said successive portions and thereby continuously join said abutting edges together.

7. A seamed article made in accordance with the process of Claim 3.

8. A seamed article made in accordance with the process of Claim 4.

9. A seamed article made in accordance with the process of Claim 5.

10. A seamed article made in accordance with the process of Claim 6.

11. A bonded article comprising two or more members having contacting surfaces bonded together wherein the bond is produced by a combination of an adhesive medium and friction-producing vibration created bonds.

12. The bonded article of Claim 11 wherein said adhesive medium comprises hot melt adhesive.

13. The bonded article of Claim 12 wherein the bonded area comprises a seam.

14. The bonded article of Claim 13 wherein the seam is a butt seam.

15. The bonded article of Claim 13 wherein the seam is an overlap seam.

16. The bonded article of Claim 13 wherein the members are comprised nonwoven fabrics.

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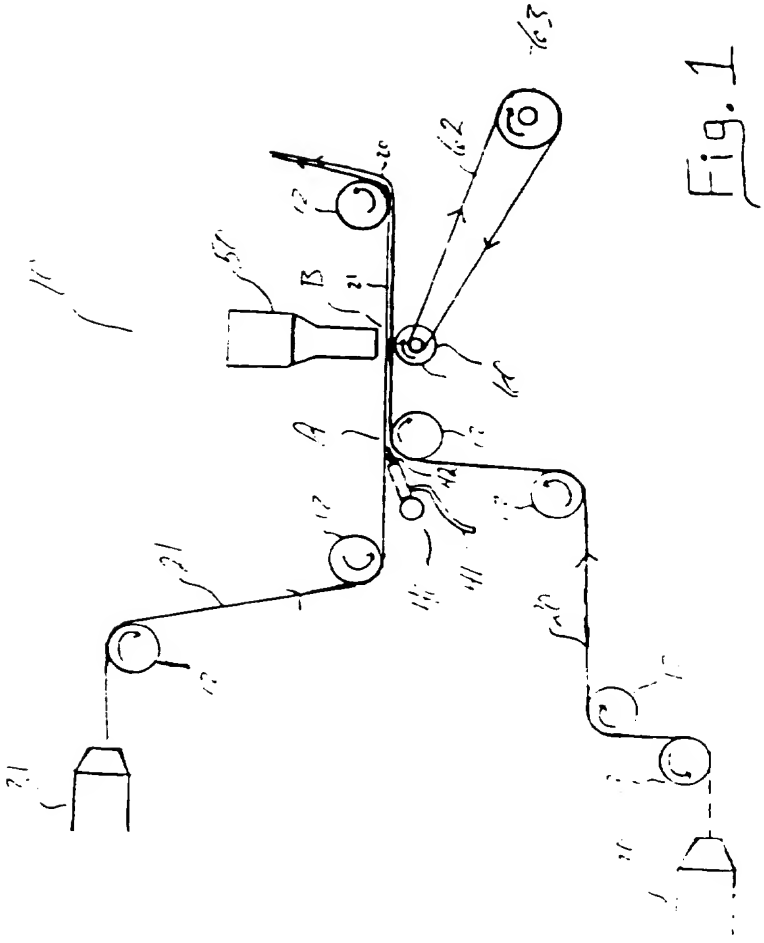
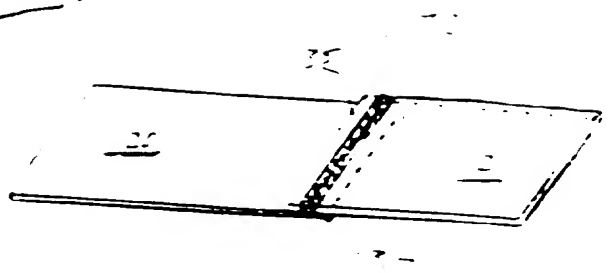


Fig. 1

Fig. 3



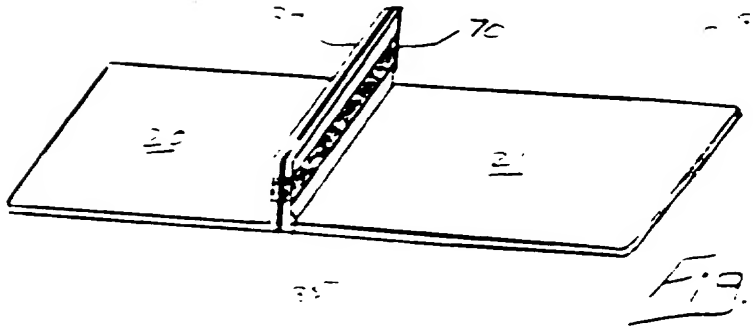


Fig. 2

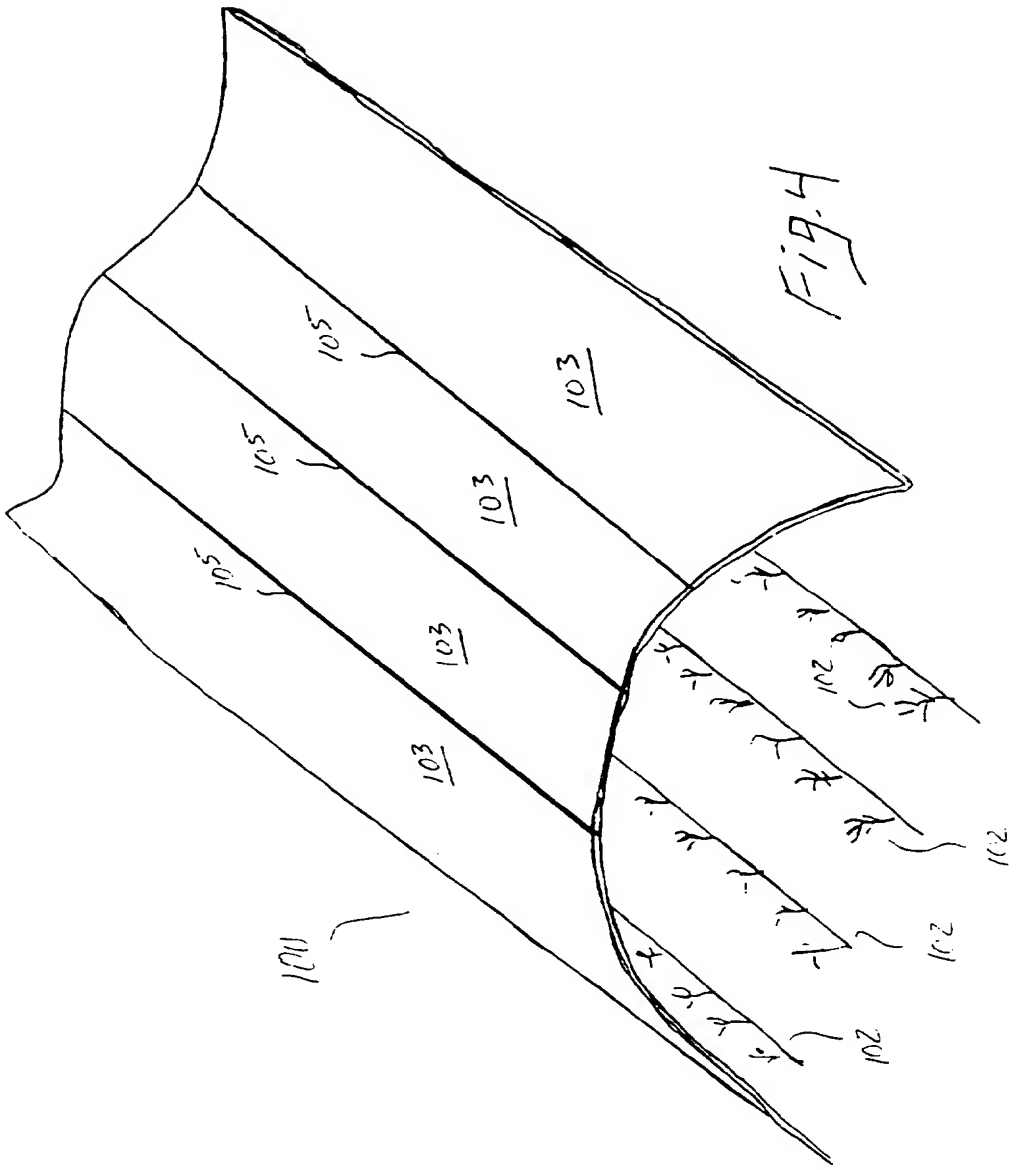


Fig. 4